

The terrestrial mammal-fauna of the Dutch Wadden-Islands

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I. Introduction

A few years ago a short article was published on the mammal-fauna of the Dutch Wadden-islands (VAN LAAR, 1957) in a stenciled edition of the Nederlandse Jeugdbond voor Natuurstudie (Dutch Youth League for Nature Studies). Though containing a useful summary, the main conclusion was that, with regard to the mammal-fauna only Texel had been properly investigated and there proved to be very few data concerning the other islands.

As the State Institute for Nature Conservation Research (R. I. V. O. N.) recorded many data on these other islands in the last few years, evidently the moment had come to summarize all of these in a survey to be published.

II. Texel

An excellent survey of all data known on the mammal-fauna of Texel was published by VAN LAAR (1960) a few years ago.

A few supplementary analyses of owl-pellets (KLAAS, 1961; DE VRIES, 1957 and 1960) did not yield any fresh data (Table No. 1).

Even though presumably everything was known as regards the mammal-fauna on this island, the investigation of KNOEST & MONDEEL (1961) proved to be significant. Already earlier (VAN LAAR & JUSTESSEN, 1956) a lower jaw of the harvest-mouse (*Micromys minutus* Pall.) had been found in a lot of pellets. This species had never been found on Texel before. The above-mentioned investigators found 2 remainders of the cranium of *Micromys minutus* and now there is a tendency to suggest that this species has appeared on this island rather suddenly. As so many and such large amounts of pellets have been analysed formerly, it seems most improbable that it was overlooked. Recently, we have found the same on Ameland. This will be treated more elaborately in considering the mammal-fauna of that island.

A few articles not mentioned in the publication of VAN LAAR (1960) and articles on the occurrence of mammals on Texel published more recently have been included in the references. Special attention should be paid to a species not mentioned in this survey of Texel: the pipistrelle, *Pipistrellus pipistrellus* (Schreb.) (DRIJVER, 1958).

III. Vlieland

Much less was known about the mammal-fauna on this 18 km long island. SCHREUDER (1945) in pellet analyses only found longtailed fieldmouse (*Apodemus sylvaticus* [L.]) and house mouse (*Mus musculus* L.) on this island. TINBERGEN (1932) only found the remains of longtailed fieldmice in owl pellets.

¹ Prof. Dr. KLAUS ZIMMERMANN dedicated for his 70th birthday.

This species even occurs as inhabitant of the uttermost West point of the Vliehors in the seal film from before the war (TER PELKWYJK).

The investigation of VAN BEMMEL & MÖRZER BRUIJNS (1937) only proved the presence of longtailed fieldmice and house mice. According to SCHREUDER (1947) the remains of voles (*Microtus arvalis* [Pall.]) have been found in owl pellets from Vlieland. This has never been confirmed by more recent investigations and according to us voles do not occur here. A written communication of Mr. BUITENHUIS (1963) informed us that the hedgehog (*Erinaceus europaeus* L.) also is present on Vlieland. We do not know when this species was introduced on this island.

According to VAN WIJNGAARDEN & DE VRIES (1953) Norway rats are not present on Vlieland. Personnel of the Rijkswaterstaat (State Department for Public Works) maintains (oral communication of MÖRZER BRUIJNS) that Norway rats should have reached this island several times in ships loaded with osier. Until now, however, they have not been successful in establishing.

MÖRZER BRUIJNS (1958) has published an article on the results of an outbreak of myxomatosis under the rabbits of this island. This article contains data on the population density of this species as compared to the densities in other dune areas. Concerning bats, the following is known (BELS, 1952): one great bat (*Nyctalus noctula* [Schreb.]) was caught (1926) and one long-eared bat (*Plecotus auritus* [L.]) was observed (1936). In all probability these animals should be considered as wandering or migrating animals, as according to us the island is unsuitable as a habitat.

IV. Terschelling

Many widely spread data on the mammal-fauna of this island have been summarized in the article of VAN WIJNGAARDEN & MÖRZER BRUIJNS (1961). A list of the present species and a list of references is to be found in this publication (common shrew, *Sorex araneus* L.; pigmy shrew, *Sorex minutus* L.; hedgehog, *Erinaceus europaeus* L.; Norway rat, *Rattus norvegicus* [Berkenh.]; house mouse, *Mus musculus* L.; longtailed fieldmouse, *Apodemus sylvaticus* [L.]; rabbit, *Oryctolagus cuniculus* [L.]; stoat, *Mustela erminea* L.). No fresh data have been received since this publication. A description of the longtailed fieldmice (*Apodemus sylvaticus* [L.]) living on this island has been published by PELT & VAN BREE (1962).

V. Ameland

All landscape types characteristic of the Wadden-islands are to be found on Ameland, which is 22 km long. The mammal-fauna, however, is strikingly poor. The first data on this were obtained from pellet analyses by L. & N. TINBERGEN (published in SCHREUDER, 1945, and IJSSELING & SCHEYGROND, 1950, see table No. 1). In 1957 DE VRIES analysed a second lot of pellets (DE VRIES, 1957). In 1962 the mammal-fauna could be investigated for a fortnight, during a combined study camp of the State Institute for Nature Conservation Research and the Utrecht Biologist Association. By means of the 5 well-known methods, viz. pellet analyses, taking away preys from predatory birds, traps, information of game-keepers and direct observations, it could be established what mammals were present on this island. The results were as follows:

Erinaceus europaeus L., Hedgehog. — Hedgehogs have recently been introduced on the island, the exact date could not be traced. At the moment they live distributed all over the island in rather great numbers (observations in the "Oerd", "Nesserbosch", "Roosduinen" and near the lighthouse).

(de VR. = DE VRIES; v. W. = VAN WIJNGAARDEN)

Island	Locus	Author	Predator	Date	Number of pellets	<i>Sorex aran.</i>	<i>Sorex min.</i>	<i>Neomys fod.</i>	<i>Arvicola terr.</i>	<i>Microt. arv.</i>	<i>Microt. pec.</i>	<i>Microm. min.</i>	<i>Apod. sylv.</i>	<i>Rattus norv.</i>	<i>Mus musc.</i>
cel plement of N LAAR, 1960)	De Dennen	DE VR. '57	<i>Asio ot.</i>	12/4 '52	4	—	—	1	—	9	—	—	—	—	—
	De Dennen	DE VR. '60	<i>Asio ot.</i>	spring '52	50	—	—	2	—	85	—	81	—	—	—
	Staatsbos S. Duin & Bos	KLAAS '61	<i>Asio ot.</i>	—	?	—	—	1	—	102	—	76	3	—	—
	Staatsbos S. de Koog	KNOEST ca. '61	<i>Asio ot.</i>	7/4 '61	50	—	—	—	—	11	—	40	—	1	—
	Staatsbos S. Duin & Bos	KNOEST ca. '61	<i>Asio ot.</i>	7/4 '61	400	—	—	3	—	324	2	284	7	—	—
eland	Boomenland Nwe Loo	DE VR. '57	<i>Asio ot.</i>	3/51	9	—	—	—	—	—	—	1	—	—	—
		DE VR. '60	<i>Asio ot.</i>	18/5 '59	5	—	—	—	—	—	—	5	—	—	—
schelling	Midsland	VAN LEEU- WEN '53	<i>Tyto alba.</i>	1/51	2	17	—	—	—	—	—	—	—	—	—
	Duinen pl. 18	DE VR. '60	?	17/5 '59	1	1	—	—	—	—	—	—	—	—	—
	Jan Willemskooi	DE VR. '60	<i>Asio flam.</i>	13/2 '58	4	—	—	—	—	—	—	5	—	—	—
	Badweg Oosterend St. Jansplak	DE VR. '60	<i>Asio flam.</i>	17/5 '59	11	3	—	—	—	—	—	1	—	—	—
		VAN LAAR '61	?	23/9 '59	?	6	—	—	—	—	—	1	—	—	—
eland	Hollumerbosch	v. W.	?	7/62	3	—	—	—	3	—	—	—	—	—	—
	Hollumerduinen	v. W.	?	7/62	38	—	—	—	23	—	—	3	—	—	—
	Lange duinen	v. W.	?	7/62	5	—	—	—	5	—	—	—	—	—	—
	Lange duinen	v. W.	<i>Falco tinn.</i>	7/62	38	—	—	—	7	—	—	—	—	—	—
	Lange duinen	v. W.	<i>C. cyn.</i>	7/62	9	—	—	—	7	—	—	—	—	—	—
	Lange duinen	v. W.	<i>pyr. Asio flam.</i>	7/62	9	—	—	—	3	—	—	—	—	—	—
	Lange duinen	v. W.	<i>pyr. Asio flam.</i>	7/62	1	—	—	—	1	—	—	—	—	—	—
	Vliegveld	v. W.	<i>Asio flam.</i>	7/62	1	—	—	—	2	—	—	—	—	—	—
	Zwanenwaterduinen	v. W.	<i>Asio flam.</i>	7/62	10	—	—	—	11	—	1	1	—	—	—
	Kooi S. B. B.	v. W.	?	7/62	14	—	—	—	2	—	2	—	—	—	—
	Ballumerheide	v. W.	<i>Asio flam.</i>	7/62	3	—	—	—	1	—	2	—	—	—	—
	Roosduinen	v. W.	?	7/62	29	—	—	—	16	—	2	1	—	—	—
	Nesserbos	v. W.	?	7/62	67	—	—	—	37	—	—	2	1	—	—
	Nesserbos	v. W.	<i>F. tinn.</i>	7/62	—	—	2	—	3	—	—	—	—	—	—
	Burensebos	v. W.	?	7/62	180	—	—	—	194	—	—	8	1	—	—
	Oerdt	v. W.	?	7/62	1	—	—	—	1	—	—	—	—	—	—
	Nes	DE VR. '57	<i>Asio ot.</i>	29/3 '54	?	—	3	—	2	—	—	3	—	—	—
	?	DE VR. '57	<i>Asio ot.</i>	20/6 '54	10	—	—	—	7	—	—	2	—	—	—
	?	DE VR. '57	<i>Asio ot.</i>	3/54	?	—	—	—	69	—	—	5	—	—	—
	?	DE VR. '57	<i>Asio ot.</i>	3/54	?	—	—	—	31	—	—	10	—	—	—
iermonnikoog	Vrederust	DE VR. '60	?	13/9 '59	3	—	—	—	—	—	—	1	—	—	—
	Kronkelpad	DE VR. '60	?	3/9 '58	4	—	—	—	—	—	—	1	—	—	—

Sorex araneus L., Common shrew. — This species has been found only once in pellets (SCHREUDER, 1945, IJSSSELING & SCHEYGROND, 1950). Its presence could not be confirmed on Ameland in 1962.

Sorex minutus L., Pigmy shrew. — This species was not known to be present on this island. One individual was taken away from a kestrel in the "Nesserbosch" (4-7-'62), one was caught in the "Ballumer Mieden" (10-7-'62).

Microtus arvalis (Pall.), Continental Vole. — The investigation of TINBERGEN already proved that voles were present in very great numbers on this island. In a

recent investigation it was evident that they were not only numerous in the "ordinary" vole habitats, such as road sides and hayfields in polders, but also in the moist dune valleys, even up to the coastal dune ridge and in the rather dry "Roosduinen" (*Calluna* — *Erica*-vegetation). The latter is probably due to the lack of competition with closely related species. It could not be traced any more whether the vole was



originally present on the island or whether it was reached via the dike which connected the island with the mainland from 1870 to 1872. At present they are an important staple food of the dense population of birds of prey. Moreover, this is a most suitable opportunity to study the possible ecological amplitude of this species, as there are no normal competitive relations.

Micromys minutus (Pall.), Harvest mouse. — The presence of this species on this island was proved in 1962 by the discovery of the remains of 7 individuals in pellets. Unfortunately the animals could not be caught, despite the many attempts to catch them in seemingly suitable habitats. It has been suggested that this is a question of recent introduction, due to the fact that the harvest mouse was not present in the extremely large number of pellets analysed by the TINBERGENS at one time, which showed the presence of over 3000 animals of prey. To wit, scores of small summer houses with thatched roofs have been built on Ameland in the last few years. The reed for this generally comes from the Northwest of Overijssel or from Friesland. It is loaded on lorries which cross by ferry and are unloaded at the building site. Introductions of this kind are quite feasible, as it is well-known that harvest mice are often brought into barns with loads of unthreshed cereals. As for the "sudden" presence of this species on Texel, we do not consider that recent introduction is truly proved, but we do think it is quite plausible.

Apodemus sylvaticus (L.), Longtailed fieldmouse. — Contrary to the results of TINBERGEN the longtailed fieldmouse did not prove to be numerous in the pellets in 1962. They were neither caught in traps. However, this species undoubtedly is present all over the island.

Rattus norvegicus (Berkenh.), Norway rat. — In 1953 Norway rats were not yet present on this island (VAN WIJNGAARDEN & DE VRIES). At the moment, however, they are distributed everywhere, especially in the polders and around the houses. The species was introduced by ships carrying osier for dike works on the Southwest coast

a few years before 1955 (HERBER, 1957). Since that time they have increased first, but are intensively controlled since 1957.

Mus musculus L., House mouse. — House mice live on Ameland, naturally only in the houses.

Oryctolagus cuniculus (L.), Rabbit. — Although a second myxomatosis outbreak occurred on this island the animals still lived in great numbers in the dunes. A striking fact is that there are many individuals among the wild rabbits, which do not only have the colour, but also the build of tame varieties. These undoubtedly are the offsprings of tame rabbits run wild. We think this is due to the fact that four-legged predators are not present on this island, there is no selection towards the wild variety, as there is no predatory pressure.

Lepus europaeus Pall., Hare. — Hares, though not in great numbers, occur everywhere in the polders and wet dune valleys on this island.

Capreolus capreolus (L.), Roedeer. — A roebuck was observed for the first time on this island in 1945. It had come here by itself. Apparently, the animals can reach this island walking and swimming. A living male was fished from the water between Ameland and Holwerd in 1961, in 1962 a dead one was found. From the dike at Holwerd roedeer have frequently been seen on the Wadden. On 27-7-'62 another roedeer crossed the Wadden sea between Holwerd and Ameland. After 1945 a female roedeer was released. After its first mate had been killed by dogs it found a second male, which had reached the island. At present there are some 20 to 30 roedeer. They mainly live in the surroundings of the old duck decoy in the „Zwanenwaterduinen“ (VAN HAAFTEN, 1962). In order to maintain a reasonable roedeer population on the island it is necessary to set up some refuge areas.

Chiroptera. — Bats have only been seen near the Roman Catholic Church at Nes, which could not be further investigated. Maximally 6 flying bats were observed here. Probably these were individuals of the species *Eptesicus serotinus* (Schreb.), serotines. Inspections of the Reformed Churches at Hollum, Ballum and Nes have not been successful.

VI. Schiermonnikoog

Although there is a rich variety of landscapes on this small island, the mammal fauna is very limited. An investigation was carried out here in 1958 and 1959.

Erinaceus europaeus L., Hedgehog. — In 1938 or 1939 two pairs of hedgehog were introduced here. At the moment they are numerous all over the island. Hedgehogs are intensively controlled as they are a pest and cause much damage, especially in the bird colonies.

Apodemus sylvaticus (L.), Longtailed fieldmouse. — This species is present all over the island (caught on the camping, 1958, „Vrederust“, 1959). Solely longtailed fieldmouse was found in the pellets (DE VRIES, 1959).

Mus musculus L., House mouse. — These animals, initially introduced, occur in houses and farms.

Rattus norvegicus (Berkenh.), Norway rat. — In 1942 Norway rats were introduced on the island with material from the German army (VAN WIJNGAARDEN & DE VRIES, 1953; DE VRIES & VAN WIJNGAARDEN, 1957). Since that time they have been controlled. During the investigation it was evident that they were widely distributed and that the population was very dense near the camping and the refuse dump.

Oryctolagus cuniculus (L.), Rabbit. — The rabbit population is sometimes very dense on Schiermonnikoog. The first myxomatosis outbreak occurred in 1958, but the disease took a very mild course.

Similar as on Ameland there are many rabbits with the colours and build of tame varieties. According to DIJKSTRA (1960) this was already the case in 1930.

Lepus europaeus Pall., Hare. — It is a known fact that this species was originally introduced. The exact date, however, could not be traced anymore. At the moment there is a dense population on the island, for instance in the „Bankert-polder“.

Capreolus capreolus (L.), Roedeer. — The first roebuck on Schiermonnikoog was observed in 1953. After 1½ year it recrossed the mudflats again after some ineffectual attempts. In the summer of 1958 there was another roebuck for a short time. The animals preferably lived in the moist part between „Kronkelpad“ and the „Prins Bernhardweg“.

VII. The five most eastern islands

In investigating the mammal-fauna on Eastern Flevoland and the small islands in the „Veluwemeer“, it was evident that small mammals were capable of crossing surprisingly heavy ecological barriers. Unexpectedly rapid new habitats were occupied. For this reason I decided to observe what other mammals lived on these eastern islands of the Netherlands, while being on a visit in order to investigate the seal population there.

Going from West to East we find five „island“ and „small islands“. In this case an island is considered an area of sand that remains dry during a normal spring tide (H.H.W.S.).

These islands are:

a. Simonszand

This is a very high sand shallow 4 km long and 2 km wide. Here and there a clump of Sand couch (*Agropyron junceum* Beauv.) is to be found, but there is no other vegetation. Formerly, there were a few low dunes (KOSTER, 1923).

No terrestrial mammals were found here. Probably the whole shallow is flooded during high spring tides.

b. Rottumerplaat (or Noordwestplaat)

In 1910 THIJSSSE visited this island (THIJSSSE, 1911a). It is evident from his description that at that time it still was a bare shallow with a few small dunes. The next year already these small dunes were larger (THIJSSSE 1911b). In 1916 there already was a nice steep dune with a dense vegetation at the Northwest point (THIJSSSE, 1916b and 1917). The dunes had also grown considerably up to 7 or 8 m (OUDEMANS, 1916).

Since 1945 the Dienst Landaanwinning of the Rijkswaterstaat (State Department for Public Works, Department for Land Accretion), has been busy enlarging the island by means of setting faggot fences and marram plantings. At the moment there is a solid dune centre and a single artificial ridge of mobile sand running in westerly direction. There is a saltmarsh behind this dune ridge. It has now become a suitable habitat for longtailed fieldmice, *Apodemus sylvaticus* (L.), and common shrews, *Sorex araneus* L. Both species, however, were as yet not present during the investigation of October 1959 and September 1960. It is, however, quite feasible that they do reach this island at some time with shiploads of osier for fencing. Other terrestrial mammals have neither been found on this island.

c. Boschplaat

This shallow which is only about 100 ha at high tides is situated relatively low and is soon flooded in storm tides. It has no dunes. There is a small house for shipwrecked people. Mammals are not present.

d. Rottumeroog

This small island which shifts more and more to the East, has already been described many times. At the moment it consists of a group of artificial dunes and a ridge of wandering dunes, regularly eroding, in the West. Between these there are some pastures and saltings, besides a house with a barn belonging to the beach master. A new ridge of mobile sand runs in easterly direction and a wide strand area with some small mobile dunes in the East joins this.

The following is to be observed about the terrestrial mammal-fauna:

Oryctolagus cuniculus (L.), Rabbit. — According to COHEN (1840) the rabbit population on this island, which was much larger at that time, was "not quite so dense anymore as it used to be". According to DROSTE-HÜLSHOF (1869) they had been exterminated in the concerning year. In 1902 they apparently were not present as yet (ANON, 1902). THIJSSSE (1912) also mentions that they had been exterminated long ago to protect plant growth, in as far as they had not been destroyed by storm tides. No data are known from the following period. In 1959, however, there appeared to be a reasonable rabbit population on the island. When these animals had been introduced was not known, it must have happened after 1912. The first myxomatosis outbreak was in 1958, it did not take a serious course though. There was a second outbreak in 1960.

Lepus europaeus Pall., Hare. — THIJSSSE (1912) mentions a hare on this island, though nobody knows how it got there. Later on this animal had vanished. The beach master introduced another hare afterwards, which could neither maintain itself. In 1959 and 1960 one hare was noticed again.

Erinaceus europaeus L., Hedgehog. — One hedgehog was introduced once, but the animal had disappeared after a few months.

Rattus norvegicus (Berkenh.), Norway rat. — A Norway rat has been observed on the island now and again, generally they are introduced with shiploads of osier for fencing. Mostly the animals are killed at once when unloading. At one time one animal lived somewhat longer under a chicken house, but this one also died in the long run.

Other mice- and vole-species or small insectivores do not live on the island according to the beach master, Mr. J. TOXOPEUS. This was confirmed by the negative result of our attempts at catching with small traps. Nothing at all was caught in 360 nights. Bats were sometimes found in stacks of faggots, the species is unknown.

e. Zuiderduintjes

This is a range of low dunes overgrown with marram and situated South of Rottumeroog. They are separated from the larger island by a wide mudflat. Mammals did not appear to live in these small dunes.

VIII. Discussion

In order to facilitate a comparison between the different islands all data available have been summarized in table 2. For this, species have been distinguished which presumably were originally present and those which were almost certainly introduced. It should be realized, however, that among the species, "originally present", there are bound to be some that have been introduced long ago.

We suspect that hedgehog and stoat on Texel and the hare on Texel, Vlieland, Terschelling and Ameland have also been introduced. The roedeer, which extended its range into Ameland and Schiermonnikoog, has been indicated as an original species. When a species has been referred to as "not present", this is only positively so, when

it concerns the "true" terrestrial mammal species. The bat fauna has been but poorly investigated and therefore the indication "not present" should be regarded with some reservations.

The first striking fact in table No. 2 is the considerable percentage of introduced species in the fauna of these islands. This means that the leveling process as far as this is concerned has already gone very far. In future this process undoubtedly will continue, due to the intensification of traffic. Should plans be realized in the future to connect the islands with each other and with the mainland by means of dams or dikes, all differences with the mainland are bound to disappear rapidly. This will be especially harmful for the northern vole, *Microtus oeconomus*, on Texel.

Table 2

Survey of the distribution of the mammal fauna on the Dutch Waddenislands

	<i>Erimaceus eur.</i>	<i>Sorex aran.</i>	<i>Sorex min.</i>	<i>Neomys fod.</i>	<i>Arvicola terr.</i>	<i>Microtus arv.</i>	<i>Microtus oec.</i>	<i>Microtus min.</i>	<i>Apodemus sylv.</i>	<i>Rattus norv.</i>	<i>Mus musc.</i>	<i>Oryctolagus c.</i>	<i>Lepus eur.</i>	<i>Lutra l.</i>	<i>Mustela erm.</i>	<i>Mustela ntv.</i>	<i>Capreolus cap.</i>	<i>Pipistrellus pip.</i>	<i>Eptesicus ser.</i>	<i>Plecotus auritus</i>	<i>Nyctalus noctula</i>
Texel	○	—	—	○	—	—	○	+?	○	+	+	+	○	z	○	—	—	○	○	—	—
Vlieland	+	—	—	—	—	—	—	—	—	†	+	+	○	—	—	—	—	—	—	z	z
Terschelling	+	○	—	—	○†	—	—	—	○	+	+	+	○	—	+	†	—	—	—	—	—
Ameland	+	○	○	—	—	+?	—	+?	○	+	+	+	○	—	—	—	○	—	?	—	—
Schiermonnikoog	+	—	—	—	—	—	—	—	○	+	+	+	+	—	—	—	z	—	—	—	—
Rottumerplaat	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Rottumeroog	†	—	—	—	—	—	—	—	—	†	—	+	+	—	—	—	—	—	—	—	—

○ originally present — ○† it, exterminated — + introduced — +? probably introduced
 — † introduced, exterminated or vanished afterwards — — not present or unknown —
 field observation only — z incidental observation, wandering or migrating animal

In the second place table No. 2 could be used in a zoögeographical study. Again it is immediately obvious that the longtailed fieldmouse is a true pioneering species, which can maintain itself almost anywhere. It is to be found in the marl pits in Limburg, on old dike remains in the (former) "Veersegat", on the embankments of willow coppices in the "Biesbosch", between the basalt blocks of an isolated breakwater in the "Ijsselmeer" in front of the "Krabbersgat" and here in the sand-couch dunes and the drifting sands of the "Vliehors" and "Boschplaat". If there is no competition with *Microtus*-species it may even reach a fairly high population density. However, it has as yet not reached the extreme easterly islands, contrary to the small German islands as, for instance, Mellum.

More or less distinctly two groups of Wadden-islands can be distinguished. To wit, on Texel *Neomys fodiens* and *Microtus oeconomus* are present as characteristic species, while there are no *Sorex*-species. We have now suggested that, in a certain phase only wandering dunes were present on Vlieland, so that only longtailed fieldmice could maintain themselves.

We consider the "Vlie", since long an important tidal estuary, to be the border line between the eastern group, where *Sorex*-species are indeed present, while *Neomys fodiens* and *Microtus oeconomus* do not occur.

However, an all-round satisfactory explanation of the distribution of mammals on the various islands cannot be found. It is most plausible that Texel was already

isolated early and that it could thus maintain its original fauna more or less unadulterated. A more difficult matter to explain is why species as *Microtus oeconomus* and *Neomys fodiens* are not present on e. g. Terschelling and Ameland. It is hardly probable that the former species should have been exterminated on Terschelling in recent times (SCHREUDER, 1945). Outbreaks of *Microtus*-species are indeed known from Texel and Ameland, the only islands with vole-species, but not from Terschelling (VAN LAAR, 1960; VAN WIJNGAARDEN, 1957). It could be explained by the fact that, with the exception of Texel with its pleistocene nucleus, there were conditions on all islands under which all habitats suitable for these species had vanished, even if only temporarily. Accordingly, a period in which wandering dunes and salt marshes were only present.

Perhaps a complete record of other, less vagrant animal groups, as e. g. molluscs and amphibia, may solve this interesting question.

Summary

A recapitulation is given of all data on the distribution of mammals on the Dutch Wadden-islands from literature. These data are completed by own investigations on the islands Ameland, Schiermonnikoog, Rottumeroog and Rottumerplaat.

Records from owl-pellets are given in table No. 1.

The results of this study are compiled in table No. 2.

The percentage of introduced mammals within the island fauna is already very large and will surely increase in future, due to the intensification of traffic.

A very interesting fauna (*Neomys fodiens* and *Microtus oeconomus*) is found on Texel, the only island with a pleistocene nucleus. This may perhaps be explained by an early isolation. The fact that these species are not present on the other islands probably can be explained by assuming that these all have passed through a stage when only wandering dunes and salt-marshes were present, while all other habitats were lacking.

Data on the introduction of many species are given as far as known.

Zusammenfassung

Nach der Literatur wird eine Zusammenstellung gegeben über alle Daten zum Vorkommen von Säugetieren auf den niederländischen Watten-Inseln. Vervollständigt wurden diese Daten durch eigene Untersuchungen auf den Inseln Ameland, Schiermonnikoog, Rottumeroog und Rottumerplaat. Funde aus Eulen-Gewölln werden in Tab. 1 zusammengestellt. Das Gesamtergebnis der vorliegenden Studie ist in Tab. 2 gegeben.

Der Prozentsatz eingeführter Säugetierarten ist in der Inselfauna schon jetzt sehr groß und wird sicherlich dank der Zunahme des Verkehrs in Zukunft weiter ansteigen.

Eine sehr interessante Fauna findet sich auf Texel (*Neomys fodiens* und *Microtus oeconomus*), der einzigen Insel mit pleistozänem Kern. Das kann vielleicht durch frühzeitige Isolierung erklärt werden. Die Tatsache, daß diese beiden Arten auf keiner anderen Insel vorkommen, kann wahrscheinlich damit erklärt werden, daß diese durch ein Stadium hindurchgingen, in dem es nur Wanderdünen und Salzsümpfe dort gab und alle anderen Habitate fehlten. — Soweit möglich wurde das Datum der Einführung für die in Betracht kommenden Arten gegeben.

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(Tx = Texel; V = Vlieland; Ts = Terschelling; A = Ameland; S = Schiermonnikoog; O = Other islands.) D. L. N. = De Levende Natuur; D. N. J. = De Nederlandse Jager.

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